Brush Electroplating Improvement Project

Status: Transitioned

PROBLEM / OBJECTIVE

Brush electroplating is commonly used by repair shipyards to conduct in-situ repair of components exhibiting damage due to corrosion, scratches, or wear. Brush electroplating repairs primarily consist of electroplating (depositing) material to build up a damaged surface of a component and refinishing the repaired area to dimensional specification. Repairs are typically performed by using hand operated anode tools and sand paper to refinish the plated area to dimensional size.

Penn State Applied Research Laboratory teamed with the NAVSEA, NUWC Keyport, electroplating and machine tool manufacturers to develop a pilot project for improving the brush electroplating repair process aboard submarines.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

The pilot project identified was a high pressure air valve (AHP), representative of two repair surface types, two inside diameters and a back seat (flat surface). The brush electroplating team collaborated to design a repair method, automating the electroplating process with subsequent machining to accurately restore AHP valve components to dimensional specification. The electroplating tools/fixtures shown in figure 1 were engineered to 1) isolate the repair area 2) encapsulate the electroplating process and 3) perform each of the preparatory and electroplating steps (forward and reverse current) using a single anode tool. The design initiative was to combine the four preparatory operations and the electroplating operation into a single step.

As for the refinishing portion of the process, the goal was to develop equipment, operable by the electroplating personnel, to accurately restore the three repair surfaces of the AHP valve component to specifications.

Implementation and Technology Transfer:

The AHP Valve is a common repair application for both the SSN 688 and the Trident Class Submarines. The tooling developed may be used to restore at least twelve of the valves per vessel. It should also be noted, the repair methodology may also be applied to several additional valves with similar configuration.

Implementation of the improved brush electroplating process method to repair the AHP valve component is scheduled for September 2005 at Pearl Harbor Naval Shipyard. All tools, fixturing, and refinishing equipment will reside at PHNSY for future repairs. Each naval shipyard will be provided with the total drawing package for manufacture or purchase of equipment through their facility.

Figure 1:
Electroplating Tools / Fixturing

Figure 2:
Refinishing Tools / Fixturing

Expected Benefits:

- This tooling was predicted to save the Navy Maintenance community 106 hours per AHP repair, translating into $238K per year potential savings Navy-wide.
- The encapsulated electroplating system eliminates contact between the electroplating personnel and the hazardous material used to restore the component, resulting in improved working conditions for the repair personnel.
- A machining tool has been designed to restore the component to dimensional specification, improving the quality/accuracy of repair.
- Process methodology may be applied to valves with similar configuration.

TIME LINE / MILESTONE

Start Date: September, 2003
End Date: September 2005

FUNDING

Total ManTech Investment: $375.0 K
Voluntary Cost Share (Shipyard support): $142.2 K

PARTICIPANTS

- Pearl Harbor Naval Shipyard &IMF
- Portsmouth Naval Shipyard
- Puget Sound Naval Shipyard & IMF
- Norfolk Naval Shipyard
- Trident Refit Facility Kings Bay
- Climax Portable Machine Tools, Inc
- SIFCO Applied Surface Concepts
- NUWC Keyport
- Penn State ARL (iMAST)